

### Solid-State Pulse Power Technology

# Pulse Technology Reduces Vulnerability from Explosion Radiation, Improves Lasers for Semiconductor Chips

[Science Research Laboratory, Inc.](#)

### Technology and Innovation

Electromagnetic radiation from an explosion or weapon device has the potential to significantly damage electronic devices, thus making them inoperable for military and/or civilian use. The U.S. military is continuously seeking more effective and affordable ways to test vital electronic assets that might be susceptible to enemy attack or compromise. Of specific concern are assets that incorporate electronic semiconductors potentially vulnerable to the electromagnetic pulses generated by nuclear or directed energy weapons. Certain tests require the production of high-power, wideband microwave radiation pulses. Conventional technology, however, has long relied on Marx banks devices, which are bulky and have difficulty operating under repetitively pulsed operation.

Under this DARPA SBIR, Science Research Laboratory (SRL) developed a new solution to this problem—called the solid-state pulsed power module (SSPPM)—using non-linear magnetic switching to generate very short (1 nSec) high-peak power pulses. SRL's novel approach involved building a unique, all-solid-state shock line, which offers the advantages of being compact and reliable, along with the ability to be repetitively pulsed at the rate of 5000 pulses per second—a significant improvement over existing technology.

As an offshoot of this technology, SRL has developed, commercialized, and

licensed their SSPPM for deep ultraviolet (DUV) excimer lasers, a key tool in the sub-0.15 micron lithographic process used for the production of the most advanced semiconductor chips. As a result, SRL has successfully transitioned its technology into large-scale commercial applications.

### Joint Collaborations

Over the years, SRL's innovative technologies have spawned a number of SBIRs and STTRs from agencies including:

- Army Research Office
- Missile Defense Agency
- Department of Energy

SRL stays in close contact with the DoD to keep abreast of new requirements and technology needs. At the same time, SRL works with the private sector to determine if government-developed technologies have commercial applications.

### Lessons Learned

- Recognize that the company's technology may be more valuable than anticipated and if needed, seek expert help to be able to negotiate the best terms for licensing or selling SBIR-developed technology.



SRL's solid-state pulsed power module

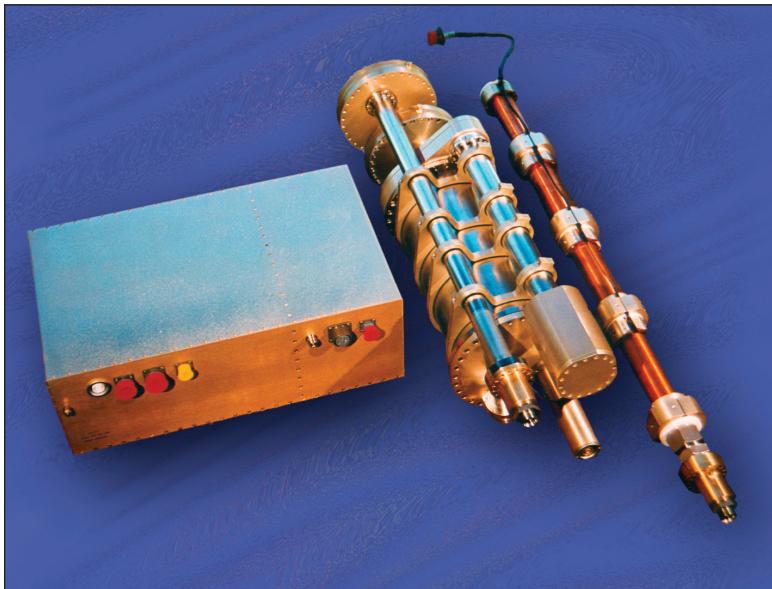
## Science Research Laboratory

- Consider approaching DARPA as a temporary funding alternative to venture capital. Venture capital can be a tempting avenue to raising funding necessary for growth, but it can mean giving up control of your company, and potentially losing the rights to the technology.

### Economic Impact

The company's DARPA SBIR contracts have been instrumental in surmounting the challenge of obtaining funds for technology demonstration. Approximately 30 percent of the company's technology development funds have derived from SBIRs.

SRL's DARPA-developed technology has also found application in commercial uses. Through an exclusive licensing agreement, the company has supplied all-solid-state krypton-fluoride (KrF) laser driver technology to San Diego-based Cymer, Inc. Using its SSPPM, SRL was able to improve the lifetime of the driver from 1 billion shots (two weeks of operation) to 100 billion shots (four years). Coupled with specialized energy-recovery circuits, SRL's technology results in a 50 percent reduction in the operating cost of the excimer laser. These drivers are now used with lithographic tools manufactured by ASML, Canon, and Nikon, which are in turn sold to companies such as Intel and IBM for the production of semiconductors. As a direct result of its license for SRL's SSPPM technology, Cymer, Inc. is the world's top supplier of excimer laser light sources for DUV photolithography systems used in chipmaking, with 85 percent of the excimer laser market.



As an offshoot of the technology developed under the SBIR, SRL commercialized and licensed a device that drives DUV lasers in semiconductors. SRL built the first 50 units before transferring the technology, and now 2,500 of these devices are used in semiconductor facilities around the world.

### About the Company

Science Research Laboratory, Inc.—based in Somerville, Massachusetts—is a technological research and development corporation founded in 1983. The company's primary objective is to develop commercial products based upon research programs conducted for the United States government. SRL currently employs 10 individuals, most of whom are scientists holding doctorate degrees from top ranked and distinguished universities. ■

### Company Information

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